WHAT IS CLAIMED IS:

1. A method for optimizing the conditions of illumination of a lithographic apparatus by computer simulation, the lithographic apparatus comprising an illuminator and a projection system, the method comprising:

defining a lithographic pattern to be printed on a substrate;

selecting a simulation model;

selecting a grid of source points in a pupil plane of the illuminator;

calculating separate responses for individual source points, each of the responses representing a result of a single or series of simulations using the simulation model; and

adjusting an illumination arrangement of the illuminator based on analysis of accumulated results of the separate calculations.

2. A method according to claim 1, wherein each of the responses is a focus exposure matrix and results in a process window that includes dose latitude and depth of focus information.

3. A method according to claim 1, further comprising calculating a response of trial illumination schemes by averaging separate responses for the individual source points contained within the illumination arrangement.

4. A method according to claim 1, wherein the response is E1:1, dense to isolated feature bias, arbitrary feature size biases, sidelobe printing, film loss, sidewall angle, mask error enhancement factor, linear resolution, or absolute resolution

5. A method according to claim 1, further comprising mapping the responses as a function of individual source point positions.

6. A method according to claim 3, further comprising applying a dose weighted averaging of the responses.

7. A method according to claim 1, wherein a spacing of the grid is within a range from 0.01 to 0.2.

8. A method according to claim 1, wherein the simulated grid is interpolated to increase the grid point density to aid in averaging.

9. A method according to claim 1, wherein adjusting the illumination arrangement includes adjusting the illumination arrangement by varying a position of an axicon/zoom module relative to a pyramidal prism, a position of a diffractive optical element, a position of an aperture blade, or by adjusting a programmable mirror array.

10. A method according to claim 1, wherein adjusting the illumination arrangement includes selecting a multipole illuminator arrangement.

11. A method according to claim 1, wherein adjusting the illumination arrangement includes defining an illumination arrangement with a multipole generating element.

12. A method according to claim 1, wherein selecting a simulation model comprises choosing a resist process to be used to print the pattern on the substrate.

13. A method according to claim 12, wherein the resist model is a calibrated model capable of adequately predicting experimental results.

14. A method according to claim 12, wherein defining the resist model includes defining a resist model taking into account at least one of vector effects, non-zero diffusion of active species, and finite dissolution contrast.

15. A method according to claim 1, further comprising calculating a metric representing variation of the separate responses for individual source points with defocus and wherein adjusting the illumination arrangement comprises adjusting the illumination arrangement based on analysis of the metric.

16. A method according to claim 15, wherein calculating the metric comprises:

applying a defocus;

calculating separate defocus responses for the individual source points at the defocus, each of the defocus responses representing a result of a single or series of simulations using the simulation model; and

comparing the separate responses with the separate defocus responses for individual source points.

17. A method according to claim 16, wherein the comparing comprises determining separate metric responses for individual source points.

18. A method according to claim 17, wherein the separate metric responses correspond either to an augmentation of the value of the defocus response or a diminution of the value of the defocus response.

19. A method according to claim 17, wherein the determining comprises subtracting the separate defocus responses from the separate responses for individual source points.

20. A method according to claim 17, wherein adjusting the illumination arrangement comprises mapping the metric responses as a function of individual source point positions.

21. A method according to claim 18, wherein adjusting the illumination arrangement comprises selecting an illumination arrangement capturing source points having opposite metric response behaviors.

22. A method according to claim 15, wherein the defocus is within a range from 0.02 to 0.4μm.

23. A method according to claim 15, wherein selecting a simulation model comprises selecting one of a full resist model, an aerial image model, a lumped parameter model and a variable threshold resist model.

24. A method according to claim 23, wherein the resist model is a calibrated model capable of adequately predicting experimental results.

25. A method according to claim 24, wherein the resist model includes defining a resist model taking into account at least one of vector effects, non-zero diffusion of active species, and finite dissolution contrast.

26. A method according to claim 15, wherein the separate responses comprise one of a critical dimension of the pattern and an intensity threshold.

27. A method according to claim 15, wherein adjusting the illumination arrangement comprises selecting an illumination arrangement so that the variation of the separate responses is minimized or reduced through defocus.

28. A method according to claim 15, further comprising calculating other separate responses for individual source points, each of the other responses representing a result of a single or series of simulation using the simulation model.

29. A method according to claim 28, wherein adjusting the illumination arrangement comprises adjusting an illumination arrangement based on analysis of the other separate responses.

30. A method according to claim 28, wherein the other responses comprise one of exposure latitude, depth of focus, E1:1, dense to isolated features bias, arbitrary feature biases, sidelobe printing, film loss, sidewall angle, mask error enhancement factor, linear resolution and absolute resolution.

31. A method according to claim 28, further comprising mapping the other separate responses as a function of individual source point positions.

32. A method according to claim 15, further comprising mapping the variation of the separate responses as a function of individual source point positions.

33. A method according to claim 15, wherein a spacing of the source point in the grid is within a range from 0.01 to 0.2 .

34. A method according to claim 15, wherein adjusting the illumination arrangement includes varying a position of an axicon/zoom module relative to a pyramidal prism, a position of a diffractive optical element, a position of an aperture blade, or by adjusting a programmable mirror array.

35. A method according to claim 15, wherein adjusting the illumination arrangement includes selecting a multipole illuminator arrangement.

36. A method according to claim 1, further comprising defining at least one aberration set for the projection system and wherein calculating separate responses for individual source points comprises calculating separate responses for individual source points and for the at least one aberration set.

37. A method according to claim 36, wherein calculating separate responses for individual source points and for the at least one aberration set comprises calculating for each source point separate responses with the aberration set.

38. A method according to claim 37, further comprising comparing for each source point the separate responses and determining the greatest one.

39. A method according to claim 38, wherein the response is a CD variation of the lithographic pattern.

40. A method according to claim 39, further comprising mapping the greatest CD variation as a function of individual source point positions.

41. A method according to claim 36, wherein the at least one aberration set comprises aberrations that are located in separate positions in a field of the projection system.

42. A method according to claim 41, wherein the aberration set is an aberration set from or representative of a real optical system.

43. A method according to claim 41, wherein the aberrations are considered together as an overall wavefront error.

44. A method according to claim 36, wherein defining at least one aberration set for the projection system comprises defining a plurality of aberration sets, each set corresponding to an aberration set from or representative of a real projection system.

45. A method according to claim 1, further comprising defining mask assist features configured to help print the lithographic pattern on the substrate and wherein calculating separate responses for individual source points comprises calculating separate responses for individual source points with and without mask assist features.

46. A method according to claim 45, wherein adjusting the illumination arrangement comprises selecting the source points in the grid that give responses, calculated without mask assist features, substantially similar to the best responses calculated with mask assist features.

47. A method according to claim 45, wherein the mask assist features are one of optical proximity corrections, anti-scattering bars and phase shift windows provided on the mask.

48. A method according to claim 1, further comprising defining a plurality of parameters and their associated variation range and calculating a metric representing CD variation of the lithographic pattern for the plurality of parameters and for the individual source points and wherein calculating separate responses for individual source points comprises calculating separate CD variations for individual source points and for each of the plurality of parameters.

49. A method according to claim 48, wherein adjusting the illumination arrangement comprises adjusting the illumination arrangement based on analysis of the metric.

50. A method according to claim 48, wherein the CD variations for each of the plurality of parameters are treated as independent variations.

51. A method according to claim 50, wherein calculating a metric comprises calculating the quadratic sum of the CD variations for each source point.

52. A method according to claim 48, wherein the plurality of parameters comprise focus range, dose range, lens aberration, flare level, variation of pattern density and mask CD range.

53. A lithographic projection apparatus comprising:

an illumination system to provide a projection beam of radiation

a support structure to support a patterning structure which can be used to pattern the projection beam according to a desired pattern;

a substrate table to hold a substrate;

a projection system to project the patterned beam onto a target portion of the substrate;

a processor to define a lithographic pattern to be printed on the substrate, select a grid of source points in a pupil plane of the illumination system, calculate separate responses for individual source points, each of the responses representing a result of a single or series of simulations using a simulation model, and calculate an optimized

illumination arrangement based on analysis of the accumulated results of the separate calculations; and

a selectably variable beam controller that is adapted to modify a cross-sectional intensity distribution in the projection beam exiting the illumination system in accordance with the optimized illumination arrangement calculated by the processor.

54. A lithographic projection apparatus according to claim 53, wherein the processor is further configured to calculate a metric representing variation of the separate responses for individual source points with defocus and calculate a metric representing CD variation with a plurality of parameters comprising focus range, dose range, lens aberration, flare level, variation of pattern density and mask CD range.

55. A machine readable medium encoded with machine executable instructions for optimizing an illumination arrangement of an illuminator according to a method comprising:

defining a lithographic pattern to be printed on a substrate;

selecting a simulation model;

selecting a grid of source points in a pupil plane of the illuminator;

calculating separate responses for individual source points, each of the responses representing a result of a single or series of simulations using the simulation model; and

adjusting the illumination arrangement based on analysis of accumulated results of the separate calculations.

56. A device manufacturing method, comprising:

projecting a patterned beam of radiation onto a target portion of a layer of radiation-sensitive material on a substrate, wherein, prior to impinging the mask, a cross-sectional intensity distribution in the projection beam is optimized using a method comprising:

defining a lithographic pattern to be printed on the substrate;

selecting a simulation model;

selecting a grid of source points in a pupil plane of an illuminator;

calculating separate responses for individual source points, each of the responses representing a result of a single or series of simulations using the simulation model; and

adjusting an illumination arrangement of the illuminator based on analysis of accumulated results of the separate calculations.

57. A method according to claim 17, wherein the adjusting comprises weighing the individual source points.

58. A method according to claim 36, wherein defining at least one aberration set comprises defining one of a representative aberration set and a representative aberration set of specific interest for the projection system.

59. A method according to claim 36, wherein the response is a CD variation, the method further comprising mapping the CD variation as a function of individual source point positions.